Quantum Machine vs. Turing Machine

Assuming that physicists will be able to bring stability to multiple-states of a qubit, which is the major technological obstacle in bringing quantum computing to market, the task of computer scientists will be to widen the application area of quantum computers. In his recent article Michael Fitzgerald /Fitzerald2013/ sheds light on the efforts of Mike Lazaridis (to create a „Quantum Valley“ near Toronto) and of Raymond Laflamme (to create a logic board for measuring entangled photons). In this correspondence we are trying to come up with the axioms of mapping algorithms onto quantum computers, by drawing a parallel between the Turing machine and the Quantum machine.

The Turing machine, in essence, includes only two instructions: (a) skip and (b) increment. It has been proven that each and every algorithm can be mapped on the two instructions of the Turing machine.

The Quantum machine, in essence, functions as an accelerator of a traditional ControlFlow computing machine. This means that the functionality of the accelerator can be either skipped or not skipped. If not, the accelerator function is called. This call is finding the global minimum/maximum of a function and it is represented appropriately. Therefore, the quantum machine also has two basic instructions: (a) skip and (b) find minimum/maximum (using a form of simulated annealing). Consequently, the questions for computer scientists read:

1. Is it possible to map any algorithm on these two instructions?

2. If not all, what algorithms can be mapped on these two instructions?

3. For those that can, how to do the mapping?

With the above in mind, we propose three axioms: one that determines what algorithms can and what algorithms cannot be mapped. For the algorithms that can be mapped, the second defines what their characteristics are. The third axiom explains how to do the mapping.

Axiom #1: TBD

Axiom #2: TBD

Axiom #3: TBD

The above three axioms define future research related to descending theorems and collloraries thereof. XXX.

References

/Fitzgerald 2013/ Fitzgerald, M., "The Bell Labs of Quantum computing", MIT Technology Review, Vol. 116, No. 5, September/October 2013, p. 92.

/Williams 2003/ Williams, C., “Quantum Computing”, *Tutorial on Quantum Computing for “Space Mission Challenges for Information Technology” (SMC-IT’03),* Jet Propulsion Laboratory, July, 2003